CLAIMS

What is claimed is:

1. An apparatus for temperature control of an integrated circuit on a circuit board, the apparatus comprising:
a first resistor on the circuit board;
a second resistor on the circuit board; and
a heat conductive material attached to both the first and second resistors and to a surface of a package containing the integrated circuit.

2. The apparatus of claim 1, wherein the integrated circuit is coupled to the circuit board by way of a bottom surface of the packaged integrated circuit, and wherein the heat conductive material is attached to a top surface of the packaged integrated circuit.

3. The apparatus of claim 1, wherein the heat conductive material is configured between the integrated circuit and the circuit board.

4. The apparatus of claim 1, wherein the heat conductive material is attached to at least one side surface of the packaged integrated circuit.

5. The apparatus of claim 1, wherein the first resistor is configured on one side of the integrated circuit on the circuit board, and wherein the second resistor is configured on an opposite side of the integrated circuit on the circuit board.

6. The apparatus of claim 1, wherein the heat conductive material comprises a metal ribbon.

7. The apparatus of claim 6, wherein the metal ribbon is wrapped around each of the first and second resistors.

8. The apparatus of claim 7, wherein the metal ribbon is attached with a thermal adhesive to the top surface of the packaged integrated circuit.

9. The apparatus of claim 8, wherein the metal ribbon comprises a copper ribbon.

10. The apparatus of claim 8, wherein the metal ribbon comprises an aluminum ribbon.

11. The apparatus of claim 1, further comprising:
a temperature controller configured to control electrical current through the two resistors.

12. The apparatus of claim 11, further comprising:
a temperature sensor configured to measure a temperature of the integrated circuit and to provide the temperature measurement to the temperature controller,
wherein the temperature controller uses the temperature measurement as feedback data in controlling the electrical current through the two resistors.

13. The apparatus of claim 11, further comprising:
a voltage source coupled to one end of the resistors; and
at least one transistor coupled to another end of the resistors,
wherein the electrical current is controlled controlling an electrical current flowing through the transistor(s).

14. A method for temperature control of an integrated circuit on a circuit board, the method comprising:
controlling an electrical current flowing through one or more resistive element so as to control generation of heat therefrom; and

conducting the generated heat by way of a heat conductive element from the resistive element(s) to a package containing the integrated circuit.

15. The method of claim 14, further comprising:
sensing a temperature of the integrated circuit by way of a temperature sensor;
providing the temperature as feedback control data to a controller; and
utilization of the feedback control data by the controller in controlling the electrical current flowing through the resistive element(s).

16. The method of claim 15, wherein the method is applied in a temperature-uncontrolled environment.

17. The method of claim 15, wherein the method is applied to provide pre-heating of the integrated circuit, prior to application of power to the integrated circuit.

18. An apparatus for temperature control of an integrated circuit on a circuit board, the apparatus comprising:
a heater element thermally coupled to a top surface of a body containing the integrated circuit (the IC body);
a temperature sensor thermally coupled to the IC body; and
a controller configured to receive temperature data from the temperature sensor and to use the temperature data to control heat generation by the heater element.

19. The apparatus of claim 18, further comprising:
a heat spreader configured between the top surface of the IC body and the heater element.

20. The apparatus of claim 19, further comprising:
a heat sink thermally coupled to the heat spreader for efficient dissipation of heat therefrom.

21. The apparatus of claim 20, further comprising:
an insulating substrate configured between the heat spreader and the heat sink,
wherein the insulating substrate includes thermal vias to thermally couple the heat spreader to the heat sink.

22. The apparatus of claim 21, wherein the heating element is attached to a bottom surface of the insulating substrate at a location so as to be separated from the thermal vias.

23. The apparatus of claim 22, wherein thermal gel filler is used to thermally couple the heating element to the heat spreader but not directly to any of the thermal vias.

24. The apparatus of claim 18, wherein the integrated circuit is encapsulated with a sealed environment.

25. A method for temperature control of an integrated circuit on a circuit board, the method comprising:
heating a first surface of a package containing the integrated circuit using a heating element thermally coupled to the first surface; and
dissipating heat from a second surface using a heat sink thermally coupled to the second surface.

26. The method of claim 25, wherein the first and second surfaces both comprise a top surface of the packaged integrated circuit.

27. The method of claim 25,

wherein the heating element is at least partially thermally separated from the heat sink by an insulating substrate such that heat generated from the heating element is primarily directed towards the integrated circuit and not towards the heat sink.

28. The method of claim 25, further comprising:
measuring a temperature of the integrated circuit; and
using the temperature measurement in controlling the heating element.

29. The method of claim 28, further comprising:
using programmable memory to hold at least one boundary temperature to be used in the control of the heating element.